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Simulating Voting Rule Reforms for the Italian Parliament: An Economic Perspective

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Abstract The aim of this paper is to contribute to the debate about the electoral rules in Italy. In particular, we simulate some voting rules to test what is the best electoral system on the basis of a utility function that takes into account two indices — representativeness and governability. As long as governability is important, a mixed member system (75% first-past-the-post, 25% proportional representation) outperforms the others. Our tool is the software ALEX4.1.

Keywords Italian Parliament, electoral system, simulations
JEL classification A12, C88, D72

1. Introduction

In the last twenty years the issue of institutional reforms has played an important role in the Italian political debate (Padovano and Ricciuti 2008). The Executive and the Parliament did not see their structure and relevant powers changed, but changes in the voting rule took place. The Parliament is bicameral: the *Camera dei Deputati* — the Lower Chamber — has 630 legislators elected by all citizens over eighteen years old, while the *Senato* — the Upper Chamber — has 315 legislators elected by voters over twenty-five years old.[1] Both houses share exactly the same power. The electoral system changed once in 46 years,[2] and since then has changed twice in 13 years. From 1948 to 1993 the Lower Chamber was elected in relatively large multi member districts by proportional representation (PR) with D'Hondt rule. The Upper Chamber was elected on the basis of small constituencies but seats were assigned proportionally according to the regional results. Since this system provided rather unstable governments, in 1993 a referendum was called to transform the Upper House voting rule to first-past-the-post for 258 over 315 seats. The referendum achieved 82.7% of votes in favour

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[1] Former Presidents of the Republic are also *de jure* members of the Senato, and the President of the Republic can appoint up to five life Senators.

[2] In 1953 a law giving 65% of seats to the coalition obtaining 50.1% of votes passed, but did not become effective since Christian Democrats and its allies did not overcome that threshold. The law was abolished in 1954.

of the change, and subsequently the Parliament passed a bill stating that 75% of the seats of the Lower Chamber had to be elected with the first-pass-the-post system in single-member districts, while the remaining 25% had to be elected on the basis of nationwide proportional representation with a 4% threshold. For the Upper House no competing lists were considered, but still there was a mechanism aimed at reducing the effects of plurality.

In 2005 the electoral system was changed again and the current voting rule was applied. The coalition of lists obtaining the majority of votes receives at least 55% of the seats in the Lower Chamber, and there is a 2% threshold. In the Upper Chamber 55% of seats are given to the coalition winning at the regional level. This system has been widely criticised: it tends to increase the number of parties, and therefore, political fragmentation with negative effects on government stability. Furthermore, lists are closed.[3] In light of this criticism, the political arena is currently discussing several proposals to further reform the electoral rules.

In this paper we use the software ALEX4.1 (Bissey and Ortona 2007) to simulate the effects of a number of possible reforms on political representation, on the basis of the results of the 2006 elections. In particular, we focus on first-past-the-post (FPTP), proportional representation (PR), run-off, mixed plurality-proportional representation (MM1 and MM2), PR with several thresholds, PR with small districts.

The paper does not aim at simulating the results of the next elections since the political landscape has changed since 2006.[4] Rather, we study what could have happened in 2006 under different voting rules.[5] For simplicity, we concentrate on the *Camera dei Deputati*: seats in the Senate are given on a regional basis and therefore we should have applied all the voting systems simulated here to 20 regions each time. We believe that the value added of this exercise is not enough to compensate the computational costs.

The paper is organised as follows: Section 2 is devoted to the description of the data and the hypotheses we base our simulations on. The simulated voting rules are discussed in Section 3. Results are presented in Section 4. Section 5 is dedicated to a brief discussion about Condorcet and Borda. A comparison of possible reforms with the current voting rule is outlined in Section 6. Section 7 concludes. An appendix gives some details on the parties and a summary of the Italian electoral system over time.

2. Hypotheses

ALEX4.1 requires a number of inputs (in brackets, the figures assumed here):

(i) the number of voters in each constituency (100);

(ii) the size of the Parliament (630, as for real);

[3] At the time of writing this paper signatures were collected to call for three referendums aimed at changing the law. The referendums took place in June 2009 but did not passed the 50% plus one voter threshold in order to be valid. The first and the second had given 55% of seats to the list obtaining the majority of votes at the *Camera* and *Senato*, respectively. The third had prevented candidature in more than one district.

[4] The centre-right coalition (excluding UDC) won elections in 2008.

[5] However, different voting rules change the supply of parties, since they change their incentives.

(iii) the number of parties (9);
(iv) the nation-wide share of votes of each party;
(v) the probability that the *second* preferred party is next to the first preferred on the left-right axis (0.8, the default value), and the probability that it is a *second next* party (0.1 by default). These probabilities are employed to provide the full ordering of preferences needed to simulate Borda Count and Condorcet Winner for parties of every voter, through a random-number device;
(vi) the location of each party on the left-to-right axis;
(vii) the concentration of parties – if it is the case (as in our simulation).

Table 1. Basic data

	% Votes in 2006	ID	c	n
RC+Pdci	8.4	10	1.35	58
Verdi	2.2	17	1.53	50
Ulivo	33.0	34	1.38	62
RnP	2.7	38	1.52	35
Udeur+IdV	3.8	48	1.72	158
UDC+DC	7.8	60	1.45	46
FI	24.5	74	1.30	17
AN	12.8	81	1.44	46
LN	4.8	86	2.22	142

Table 1 shows the main data we use in our simulations. In the first column we report the votes obtained in the 2006 general elections, with some re-arrangements: we sum two far left parties (RC and Pdci), two centrist parties belonging to the centre-left coalition (Udeur and IdV), and two centrist parties belonging to the centre-right coalition (UDC and DC) in order to simplify the computations. In the second column we measure the ideological distance on a left-to-right scale in the range 1–100.[6] Last two columns are concerned with party concentration and the number of seats in which each party is concentrated. We assume that a party is concentrated in a constituency if the share of votes for that party is at least 1.2 times the national share. In this case, we calculate the concentration index as follows:

$$c_i = \sum_{d=1}^{D} \frac{(\vartheta_{id} \cdot \theta_{id})}{\vartheta_{id}}, \tag{1}$$

where ϑ_{id} = number of seats in the constituency d where party i is concentrated; θ_{id} = electoral result of the party i in the constituency d divided by the national electoral result; D = number of constituencies where party i is concentrated.[7]

[6] Data come from a re-arrangement of the "expert survey" by Benoit and Laver (2006). We are grateful to the authors for the permission to use them.
[7] As an example, LN is concentrated in 8 constituencies (Piemonte II, Lombardia I, II and III, Veneto I and II, Friuli – Venezia Giulia and Sicilia II), then $D = 8$.

The number of seats where the party is concentrated is equal to:

$$n_i = \frac{2}{3} \sum_{d=1}^{D} \vartheta_{id} \tag{2}$$

We consider the value 2/3 because ALEX4.1 only allows for one concentrated party in each seat. The sum of seats (if we consider as concentrated each seats of the concentrated constituency) where all the parties are concentrated would be more than 900.[8] If we sum equation (2) for all the parties $\sum_{i=1}^{9} n_i$ we reduce this number to 614 (< 630).

On the basis of basic data reported in Table 1, we simulate different electoral systems and evaluate each voting rule by means of two indices — representativeness and governability. Representativeness is defined as the distance with the respect to the one-district PR system — a voting rule that gives an almost one-to-one conversion of votes into seats. It is calculated as follows:

$$R = 1 - \sum_{i=1}^{9} \frac{\left|S_{ji} - S_{ppi}\right|}{\left|S_{ui} - S_{ppi}\right|}, \tag{3}$$

where S_{ji} is the number of seats obtained by party i with the voting system j, S_{ppi} is the number of seats obtained by party i under One-District PR, S_{ui} is the number of seats that party i has in case of maximum disproportionality (i.e., the case in which the largest party in the One-District PR gets all the seats).

Governability is based on the number of *crucial* parties (i.e., those who would destroy the government majority if they withdrew), and on the number of seats of the majority. It is given by:

$$G_j = A + B, \tag{4}$$

where $A = 1/(C+1)$, where C is the number of crucial parties in the government, and $B = \frac{n}{[(m/2)+1]} \left[\frac{1}{C} - \frac{1}{C+1}\right]$, where n is the number of seats above the majority level,[9] m is the total number of seats, and C is the total number of crucial parties. Crucial parties are defined along the political coalitions we use here, and not according to the minimum winning coalitions.

How to use these indices to compare the performance of different systems? When a system is either *dominant* among a set of systems (i.e., it enjoys the highest levels of both representativeness and governability), or *dominated* by one of them, the solution is trivial. The former is the best system while the latter is ruled out. When a trade-off between the two dimensions arises, we have to establish a criterion to decide which one is the most relevant. A possible solution is to introduce a social utility function:

$$U = G^a R^b, \tag{5}$$

where $G =$ index of governability and $R =$ index of representativeness. The relative importance of the two main dimensions is represented by the ratio a/b.[10] When its

[8] For a seat where k parties are present, $k-1$ parties could be concentrated.

[9] Half the number of seats plus one if the number of seats is even; half the number of seats plus 0.5 if it is odd.

[10] Actually, the ratio of partial elasticities may be considered a proxy for the relative weight that the community assigns to relative increase in the value of G and R. This is the main reason to choose a Cobb-Douglas form. See Fragnelli et al. (2005) for a broader discussion.

value is higher than 1, governability is more relevant than representativeness and vice versa. Obviously, the system with the highest value of U is the best one (for a further discussion and some empirical applications, see Ortona et al. 2008).

3. The simulated electoral systems

In this section we analyse what would have happened under different electoral systems. In particular, we simulate the Italian Parliament under:

(i) *One-District Proportionality* — the seats are assigned on the basis of the shares of votes in the population. This is the voting rule used in The Netherlands (but for minor differences), used as a reference to compare the other systems.

(ii) *Run-off Majority* — in each district, the two parties that obtain most votes enter the second round, where the one with most votes wins. If a party has at least 50% of the votes in the first round, it wins the seat and the second round is not necessary.

(iii) *First-Past-the-Post* — in each district, the seats are assigned to the candidate with most votes. This is the voting rule used in UK.

(iv) *Mixed Member I* (without subtraction) — part of the seats are assigned through the First–Past–the–Post system and the rest on the basis of the proportional representation. In our simulation we assign 25% of the seats through proportionality and 75% through plurality.

(v) *Mixed Member II* (with subtraction) — again, part of the seats are assigned through proportionality and the rest through plurality, but the number of votes needed to elect one MP in the First-Past-the-Post part is subtracted from the lists in the PR part, making the voting rule more proportional. We assign 25% of the seats through proportionality and 75% through plurality. This system is a proxy of the Italian electoral system from 1993 to 2005.[11]

For First-Past-the-Post, Mixed Member I and Mixed Member II we consider the possibility of *strategic voting*: most voters whose preferred party has no chance of winning will probably either abstain or vote for the second (third, etc.) preferred party. Hence what must be introduced is the possibility for the voter either to vote for a would-be winner or to vote for the preferred party. This is done through a probability, p. If the probability is 0, the voter will remain faithful to its preferred party; if it is 1, she will vote for the largest party of the coalition that party belongs to, also to be defined by the user. If $0 < p < 1$, the value of p is used to produce the choices of every voter, through a random-number device. Accordingly, p is computed as:

$$p = 1 - \frac{kL}{100}, \tag{6}$$

[11] For the two mixed member systems "contamination effects" (Cox and Schoppa 2002) are possible across the two systems, but we are unable to deal with this issue.

where $0 \leq L \leq 100$ is the distance between the preferred party and the largest party of the coalition (values are obtained from the ideological distance in Table 1), and k is a weighting parameter. We consider two values of k, 0 (which maximises strategic voting) and 5, which makes a modest strategic voting.[12]

(i) *Threshold Proportionality* — parties with a percentage of votes lower than the established threshold are excluded. The seats are distributes among the remaining parties through proportional representation. In our simulations threshold is fixed at 3%, 4%, or 5% (the voting rule used in Germany).

(ii) *Proportional Representation* (with small districts) — the voting rule used in Spain. It is based on small districts, which make the competition centred upon the two main parties, or strong regional parties. The number of representatives per district ranges from 1 to 34, with an average of 7. In the small districts the two main parties or strong regional parties get seats. The few large districts allow some representation for small non regional parties. According to Rae and Ramírez (1993), "... the system regulates the competition among parties in order to allow for the continuity of the opposition, it leaves room for to multiple voices in the Parliament and, however, it provides the strongest national party with the opportunity to govern and have to answer for its actions before the electorate." ALEX4.1 does not allow for districts of different magnitude. Therefore, we run three simulations with 5, 7 and 10 representatives per district in order to mimic the Spanish system.

4. Results

In this section we report the results obtained through the simulations. To help reading the tables we draw a dotted line between the centre-left and the centre-right coalitions. Tables also report the indices of G and R for each parliament.

Table 2 reports the results of One-District PR, Run-off and First-Past-the-Post. We can notice that First-Past-the-Post strongly polarises political representation. Under maximum strategic voting ($k = 0$) the centre-right gets a small majority, whereas when we reduce the level of strategic voting ($k = 5$) the same coalition gets a large majority. FI can even support the government alone, and this gives a large G. The Run-off also strongly reduces the number of parties in the Parliament, with the centre-right coalition obtaining a small majority.

Results for the two majoritarian systems are compared with One-District PR. Clearly, all parties are represented in this Parliament, at the expense of the main ones. By definition R is equal to one, and governability is quite low, because the resulting centre-left government has only a majority seat.

In Table 3 we present results for the two mixed systems. In these two systems the centre-right coalition always wins the elections. As in the First-Past-the-Post scenario,

[12] Simulations with higher values of k did not produce substantially different results.

a decrease in the level of strategic voting leads to a rise in the seats for FI and a reduction for Ulivo. This is due to the fact that FI is near to AN and not so far from UDC + DC and LN, while Ulivo is far from RC + PdCI.

Table 2. One-District PR, Run-off Majority and FPTP with strategic voting

	One-District PR	Run-off Majority	First-Past-the-Post	
			$k = 0$	$k = 5$
RC + Pdci	53	1	1	0
Verdi	14	0	0	0
Ulivo	208	299	307	236
RnP	17	0	0	0
Udeur + IdV	24	0	0	0
UDC + DC	49	3	7	0
FI	154	287	271	347
AN	81	40	44	47
LN	30	0	0	0
R	1	0.469	0.488	0.476
G	0.167	0.341	0.252	0.623
Majority	Centre-Left (316)	Centre-Right (330)	Centre-Right (322)	Centre-Right (394)

Table 3. Mixed Member I and II with strategic voting (75% FPTP, 25% PR)

	Mixed Member I		Mixed Member II	
	$k = 0$	$k = 5$	$k = 0$	$k = 5$
RC + Pdci	14	13	2	19
Verdi	4	4	0	4
Ulivo	282	229	304	231
RnP	4	4	0	2
Udeur + IdV	6	6	0	6
UDC + DC	17	12	6	14
FI	242	298	279	300
AN	53	56	39	48
LN	8	8	0	6
R	0.616	0.609	0.476	0.600
G	0.201	0.591	0.337	0.582
Majority	Centre-Right (320)	Centre-Right (374)	Centre-Right (324)	Centre-Right (368)

Table 4. Threshold Proportionality

	3%	4%	5%
RC + Pdci	55	58	61
Verdi	0	0	0
Ulivo	219	228	241
RnP	0	0	0
Udeur + IdV	25	0	0
UDC + DC	52	54	57
FI	162	169	179
AN	85	88	93
LN	32	33	0
R	0.927	0.869	0.797
G	0.202	0.204	0.253
Majority	Centre-Right (331)	Centre-Right (344)	Centre-Right (329)

Table 4 reports the results for simulations of the PR system with some thresholds. The results are quite different as long as the thresholds change. For example, with the three percent threshold, all parties but two are represented in the Parliament, with the five percent threshold only five parties get representatives. Representativeness is always quite high, and governability increases with higher thresholds.

Table 5. Proportional Representation with small districts

	5 MPs	7 MPs	10 MPs
RC + Pdci	12	19	48
Verdi	0	0	0
Ulivo	283	288	258
RnP	0	0	0
Udeur + IdV	0	9	16
UDC + DC	9	12	34
FI	218	192	189
AN	84	90	71
LN	24	20	14
R	0.664	0.699	0.799
G	0.255	0.250	0.252
Majority	Centre-Right (335)	Centre-Left (316)	Centre-Left (322)

Table 5 reports the results we obtained mimicking the Spanish system. The system gives a clear advantage to the two main parties. Moving from 5 to 10 MPs per district this edge is reduced, and almost all parties receive some representation. Note that a strongly regional base such as LN sees the number of its MPs reduced as long as the district magnitude increases. The opposite happens for parties that are more homogeneously represented, such as UDC + DC and RC + Pdci. Representativeness is quite high, but governability is not: although the main parties are very large, they still need to make alliances in order to make a government. The centre-right coalition prevails with the lowest district magnitude, whereas the centre-left will govern under the two other simulations (only by one seat with 7 MPs district magnitude).

5. A comparison with the current electoral system

It is interesting to compare the current system (proportional with majority top-up for the coalition that obtains the largest number of votes) with possible other voting rules. Table 6 reports the distribution of seats after the 2006 general election, and provides the indices we have calculated for the other voting rules. In Table 7 we select the best electoral system on the basis of the ratio a/b.

Table 6. Seats distribution and indices under the current voting rule

	Seats
RC + Pdci	58
Verdi	16
Ulivo	228
RnP	19
Udeur + IdV	26
UDC + DC	44
FI	139
AN	73
LN	27
R	0.902
G	0.350
Majority	Centre-Left (347)

Which is the best system? We consider two different scenarios — the case where citizens use the maximum level of strategic voting ($k = 0$) and the case where voters use a lower level of strategic voting ($k = 5$).

In the first scenario, according to our indices of G and R, First-Past-the-Post, Mixed Member I and Proportional with 7 small districts are always dominated by other systems. The situation is really different in the second scenario ($k = 5$). According to our

indices *G* and *R*, Run-off Majority, Mixed Member II and Proportional with 7 small districts are always dominated by other systems. We compare the goodness of the systems through the utility function (5). From Section 2, we know that the choice of the best electoral system depends on the value of the ratio a/b. Results are reported in Table 7. These results can be easily interpreted considering the trade-off between representativeness: for small values of a (the weight of governability in equation 5), the best system is the one that gives an almost 1:1 relationship between votes and seats (One-District PR). As long as *a* increases with respect to *b*, preference is given to less representative systems. For extreme weight of governability the First-Past-the-Post succeeds. Given a less than perfect strategic voting, the Mixed Member I seems the best electoral system. The current system performs quite well under pure strategic voting, but just a small deviation from it shows that if governability is deemed important, then Mixed Member I prevails (on mixed systems see Shugart and Wattenberg 2001). This can at least partially explain why this system is so criticised.

Table 7. Choice of the best system I

	a/b	Preferred system
$k=0$	<0.139	One-District PR
	>0.139	PR with majority top-up
$k=5$	<0.139	One-District PR
	$\in(0.139,0.75)$	PR with majority top-up
	$\in(0.75,4.673)$	Mixed Member I
	>4.673	First-Past-the-Post

6. A discussion on Condorcet winner and Borda count

This section is devoted to the results from two famous electoral systems that can be simulated using ALEX4.1: Condorcet winner and Borda count.[13] Their relevance for theoretical issues makes it worthwhile deserving a section to them.

Both Borda count and Condorcet winner require the full ordering of preferences for parties of every voter. ALEX4.1 provides it through a random-number device by using the probability that the *second* preferred party is next to the first preferred on the left-right axis and the probability that it is a *second next* party — set at the beginning by the user.

[13] According to Borda count each voter is asked to rank the list of parties. For each party is assigned 1 point to the first preferred party, 2 points to the second party and so on. The points obtained by each party are summed up for each district. The winner is the party with the smallest sum. Condorcet winner is the party that is preferred by the majority when confronted in pairs to all the other parties. Then, if we have this scenario, the assignment of the seat is straightforward. If we have a cycle, the winner is the party with the highest number of vote in the district.

In our simulation (Table 8) Borda count assigns a very large number of seats to UDEUR and IdV, which seems unreasonable. This is due to the fact that this is a consensus-based rather than a majoritarian electoral system. This implies that, as in our scenario, it may result into the election of a broadly acceptable but not preferred party. In Condorcet winner, the importance of the central party is reduced with respect to Borda, while the number of seats for large parties increases.

If we add Condorcet winner and Borda count parameters to choose the best electoral system (Table 9), we find that the latter performs better than the actual system if governability becomes relevant when voters act fully strategically and it crowds out First-Past-the-Post when $k = 5$. On the other hand, Condorcet winner is never the preferred system.

Table 8. Condorcet winner and Borda count

	Condorcet winner	Borda count
RC + Pdci	0	0
Verdi	0	0
Ulivo	305	115
RnP	9	36
Udeur + IdV	103	310
UDC + DC	32	0
FI	177	149
AN	4	20
LN	0	0
R	0.528	0.277
G	0.387	0.729
Majority	Centre-Left (417)	Centre-Left (461)

Table 9. Choice of the best system II

	a/b	Preferred system
$k = 0$	< 0.139	One-District PR
	$\in (0.139, 1.609)$	PR with majority top-up
	> 1.609	Borda Count
$k = 5$	< 0.139	One-District PR
	$\in (0.139, 0.75)$	PR with majority top-up
	$\in (0.75, 3.754)$	Mixed Member I
	> 3.754	Borda Count

7. Conclusions

This paper provides a set of simulations for the Italian electoral system that could be useful for the current debate. First, we show that there is not a system that dominates the others. The choice about the best electoral system depends on the preferences about the two dimensions we considered — representativeness and governability. Second, we find that as long as governability is more important than representativeness, the Mixed Member I tends to prevail. Interestingly, the centre-right tends to win more often than the centre-left, although in the 2006 election the centre-left won by a tiny majority. This can be caused by at least two reasons: first, the ideological distance between the parties that constitute the centre-left coalition is higher than among those of the centre-right, and under non perfect strategic voting this will mean that a higher percentage of centre-left voters would abstain or vote non-strategically (abstention is not contemplated in the software). Second, the centre-left coalition is constituted by a very large party (Ulivo) and smaller allies, and these small parties are often unable to get represented under alternative voting rules. A reorganisation of the centre-left coalition seems therefore needed.

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Appendix A1. Parties

The Italian political system is centred around two coalitions: centre-right (including AN, FI, LN, UDC + DC) and centre-left (Udeur + IdV, RnP, Verdi, Ulivo, RC + Pdci).

AN	Alleanza Nazionale (National Alliance)
FI	Forza Italia (Go Italy!)
LN	Lega Nord (Northern League)
UDC + DC	Unione Democratica Cristiana + Democrazia Cristiana
Udeur + IdV	Unione democratica per l'Europa + Italia dei Valori
RnP	Rosa nel Pugno (Rose in the Fist) — alliance between Italian Socialists and Democrats (SDI) and Italian Radicals
Verdi	Green Party
Ulivo	Olive Tree — alliance between Democrats of the Left (DS) and Democracy is Freedom (DL)
RC + Pdci	Rifondazione comunista (Communist Refoundation) + Partito dei comunisti italiani (Italian Communists' Party)

Appendix A2. The Italian electoral system over time

Period		Electoral system	
		Lower Chamber	Upper Chamber
1948–1993		Nationwide multimember districts	Region-based multimember districts
		Proportional representation with D'Hont rule	Proportional representation with D'Hont rule
1993–2005	75%	First-Past-the-Post	First-Past-the-Post
	25%	Nationwide Proportional representation with 4% threshold	Region-based Proportional representation
2005–		Nationwide Proportional representation with 2% threshold and with majority top-up (55%)	Region-based Proportional representation with majority top-up (55%)